Appendix A.

Technical Notes

Appendix A. Technical Notes

The data on doctoral scientists and engineers contained in this report come from the 1995 Survey of Doctorate Recipients (SDR). The SDR has been conducted biennially since 1973 by the National Research Council (NRC) for the National Science Foundation (NSF). Additional data on education and demographic information come from the National Research Council's Doctorate Records File (DRF). The DRF contains data from an ongoing census of research doctorates earned in the United States since 1920.

The Sampling Frame and Target Population

For the 1995 SDR the sampling frame for scientists and engineers was selected from the DRF to include individuals who

(1) had earned a doctoral degree from a U.S. college or university in a science or engineering field;

(2) were U.S. citizens or, if non-U.S. citizens, indicated they had plans to remain in the United States after degree award; and

(3) were under 76 years of age as of April 1995 (the survey reference date).

The 1995 frame consisted of graduates who had earned their degrees between January 1942 and June 1994. Persons who did not meet the age criteria (or had died) were eliminated from the sample.

The survey had two additional eligibility criteria for the survey target population. The sampled member must be resident in the United States and not institutionalized as of the reference date.

Sample Design

In 1995, the SDR sample size was 49,829. The total sample was selected from 2 groups:

(1) 1993 sample members who were still eligible in 1995, and

(2) a sample of the 1993-94 graduating cohort.

Group 1 cases were included with certainty because they are the core sample that is conveyed from year to year; group 2 cases were sampled and added to the core sample to form the total sample. A maintenance cut was done to the sample to keep the sample size roughly the same as it was in 1993.

The basic sample design was a stratified random sample. The variables used for stratification were 15 broad fields of degree, 2 genders, and an 8-category "group" variable combining race/ethnicity, handicap status, and citizenship status.

The *overall* sampling rate was about 1 in 12 (8 percent) in the 1995 SDR, applied to a population of 594,300. However, sampling rates varied considerably within and between the strata. These differences resulted from oversampling of women, minority groups and other groups of special interest, and the accumulation of sample size adjustments over the years.

Data Collection

In 1995, there were 2 phases of data collection: a mail survey and telephone followup interviewing with nonrespondents. The mail survey consisted of an advance letter and 2 waves of a personalized mailing package, with a reminder postcard between waves 1 and 2. The first-wave mailing was sent in May 1995, with the follow-up mailing sent by priority mail in July.

Phase 2 consisted of telephone interviewing. A 60 percent sample of nonrespondents to the mail survey were followed up using computer-assisted telephone interviewing (CATI). Telephone interviewing was conducted between November 1995 and February 1996.

Survey Design and Content

The 1995 SDR retained questionnaire design changes that were implemented in 1993. Most items on the 1995 questionnaire were the same as in 1993 with the addition of a section to collect data on employment history and periods of unemployment.

Response Rates

The overall response rate for the 1995 SDR was 85 percent. The response to the mail phase of the

survey was about 62 percent. (Response rates were calculated as the weighted response divided by the weighted sample cases.)

Data Preparation

As completed survey mail questionnaires were received, they were logged and transferred to the editing and coding unit at the NRC for processing. The coders carried out a variety of checks to prepare the documents for data entry. Specifically, they resolved incomplete or contradictory answers, imputed missing answers if logically appropriate, reviewed "other specify" responses for possible backcoding to a listed response, and assigned numeric codes to open-ended questions such as employer name.

Once questionnaires were edited and coded, they were sent to data entry. The data entry program contained a full complement of range and consistency checks to check for entry errors and inconsistent answers. The range and consistency checks were also applied to the CATI data via batch processing. Further computer checks were performed to test for inconsistent values; these were corrected and the process repeated until no inconsistencies remained.

At this point, the survey data file was ready for imputation of missing data. As a first step, basic frequency distributions were produced to show nonresponse rates to each question—these were generally less than 2 percent, with the exception of salary, which was 5.9 percent. Two methods for imputation were adopted. The first, cold decking, was used mainly for demographic variables that are static, i.e., not subject to change. Using this method, historical data provided by respondents in previous years were used to fill a missing response. For example, if a respondent indicated in 1993 that his birth year was 1947, but left the item blank in 1995, then "1947" was assigned to his birth year in 1995. In cases where no historical data were available, and for nondemographic variables (such as employment status, primary work activity, and salary), hot decking was used. This is the process of finding a donor with characteristics similar to the case with the missing value and using the response given by the donor as a proxy response. Hot decking involves creating groups of cases with common characteristics (through the cross-classification of auxiliary variables) and then selecting a donor at random for the case with the missing value. As a general rule, no data value was imputed from a donor in one cell to a recipient in another cell.

For a few variables, such as employer name and zip code, imputation was not performed.

Weighting and Estimation

The next phase of the survey process involved weighting the survey data to compensate for unequal probabilities of selection to the sample and to adjust for the effects of unit nonresponse. The first step was the construction of sampling weights, which were calculated as the inverse of the probability of selection, taking into account all stages of the sample selection process overtime. The sampling weight can be viewed as the number of population members the sample member represents. Sampling weights varied within cells because different sampling rates were used depending on the year of selection and the stratification in effect at that time.

The second step was to construct a combined weight, which took into account the subsampling of nonrespondents at the CATI phase. All respondents received a combined weight, which for mail respondents was equal to the sample weight and for CATI respondents was a combination of their original sample weight and their CATI subsample weight.

The third step was to adjust the sampling weights for unit nonresponse. (Unit nonresponse occurs when the sample member refuses to participate or cannot be located.) This was done in a group of nonresponse adjustment cells created using poststratification. Within each nonresponse adjustment cell, a weighted nonresponse rate, which took into account both mail and CATI nonresponse, was calculated. The nonresponse adjustment factor was the inverse of this weighted response rate. The initial set of nonresponse adjustment factors was examined and, under certain conditions, some of the cells were collapsed if use of the adjustment factor would create excessive variance.

The final weights for respondents were calculated by multiplying their respective combined weights by the nonresponse adjustment factor. In data analysis, population estimates are made by summing the final weights of all respondents who possess a particular characteristic.

RELIABILITY[1]

The statistics in this report are subject to both sampling and nonsampling error. Sampling variability occurs because a sample rather than an entire population is surveyed. Sampling errors were developed using a generalized variance procedure in order to provide approximate sampling errors that would be applicable to a wide variety of items. As a result, these sampling errors provide an indication of the order of magnitude of a sampling error rather than a precise sampling error for any specific item.

Information provided in table A-3 permits the user to calculate approximate standard errors. The general form of the equation used to model the generalized variances is $V = a + b/x$, where V was modeled in relative standard error form.

The following computational form can be used for estimating the standard error of totals using the formula

$$S_x=[ax^2+bx]^{1/2}$$

where "x" equals the estimated total and "a" and "b" are the regression coefficients provided. Values of "a" and "b" by S&E fields for selected groups are given in table A-3.[2]

Tables A-4 through A-8 present approximate standard errors associated with totals for different segments of the doctoral population. Tables A-9 through A-13 present standard error estimates for the estimated percent[3] of a subgroup having a particular characteristic.

The approximate standard error of percentages also was developed using the same general model form. Standard errors for percentages may be estimated using the computational formula

$$S_p = p[b((1/x)-(1/y))]^{1/2}$$

where p equals the percentage possessing the specific characteristic and x and y represent the numerator and denominator, respectfully, of the ratio that yields the observed percentage.

In addition to sampling error, data are subject to nonsampling error. Sources of nonsampling error include nonresponse bias, which arises when individuals who do not respond to a survey differ significantly from those who do, and measurement error, which arises when we are not able to precisely measure the variables of interest. These sources of error are much harder to estimate than sampling errors.

NOTES ON THE TABLES

The following notes facilitate use of data in the detailed tables.

Because of the changes introduced to the 1993 SDR and retained in the 1995 SDR, users are advised that data in this report are not strictly comparable with SDR data published by NSF prior to 1993.

Field of doctorate is the field of degree as specified by the respondent in the Survey of Earned Doctorates at the time of degree conferral.

Occupation data were derived from responses to several questions on the kind of work done by the respondent. The occupational classification of the respondent was based on his or her principal job held during the reference week—or last job held, if not employed on the reference week (questions A18 and A5). Also used in the occupational classification was a respondent-selected job code (questions A19 and A6).

Sector of employment was based on responses to questions A13 and A15. The category "universities and 4-year colleges" includes 4-year colleges or universities, medical schools (including university-affiliated hospitals or medical centers), and university affiliated research institutions. "Private-for-Profit" includes self-employed in incorporated business.

Geographic division was based primarily on responses to question A11 on the location of employment. Individuals not reporting place of employment were classified by their mailing address.

[1] The data and material on sampling reliability presented here are from The Methodological Report of the 1995 Survey of Doctorate Recipients (Washington, D.C. Office of Scientific and Engineering Personnel, National Research Council, forthcoming).

[2] The generalized error estimates in this report were based on a set of assumptions that did not appear to hold in the case of some small subpopulations. In such cases, the parameters listed for a higher-level field within a demographic group or a higher-level demographic group within a field were considered a useful substitute as a generalized error estimate.

[3] The estimated percent is based on the ratio of two estimated totals, where the numerator is a subset of the denominator.

Place Of Birth categories were defined as follows:

U.S. = Fifty states plus the Virgin Islands, Panama Canal Zone, Puerto Rico, American Samoa, Trust Territory, and Guam

Europe = Albania, Armenia, Austria, Belarus, Bosnia-Herzegovina, Bulgaria, Czech Republic, Croatia, Estonia, Georgia, Greece, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Ukraine, Federal Republic of Yugoslavia, Andorra, Belgium, France, Gibraltar, Luxembourg, Monaco, The Netherlands, Portugal, Spain, Switzerland, Germany, Italy, Liechtenstein, Malta, Denmark, England, Finland, Iceland, Northern Ireland, Republic of Ireland, Norway, Scotland, Sweden, Wales, Europe, not specified

Asia = Afghanistan, Bahrain, Bangladesh, Cyprus, India, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Nepal, Palestine, Saudi Arabia, Sri Lanka, Syria, Turkey, Cambodia, People's Republic of China, Philippines, Taiwan, China Unspecified, Hong Kong, Japan, Republic of Korea, Korea Unspecified, Laos, Malaysia, Singapore, Thailand, Democratic Republic of Vietnam, Republic of Vietnam, Asia, not specified

North America = Bermuda, Canada, Greenland, North America, not specified

Central America = Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Central America not specified

Caribbean = Barbados, Cuba, Dominican Republic, Haiti, Jamaica, Caribbean not specified

South America = Argentina, Bolivia, Brazil, Chile, Columbia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela, South America, not specified

Africa = Algeria, Egypt, Ethiopia, Ghana, Kenya, Libya, Morocco, Nigeria, South Africa, Sudan, Africa, not specified

Oceania = Australia, Indonesia, New Zealand, Oceania, not specified

Primary work activity was determined from responses to question A27. "Development" includes the development of equipment, products, and systems. "Design" includes the design of equipment, processes, and models.

Federal support was determined from responses to questions A40 and A41.

Tenure status was obtained from the response to question A17.

Race/ethnicity categories of white, black, Asian/Pacific Islander and Native American refer to non-Hispanic individuals only.

Citizenship status category of Non-U.S., temporary resident does not include individuals who, at the time they received their doctorate, expressed plans to leave the U.S. These individuals were excluded from the sampling frame.

Salary data were derived from responses to question A37, in which information was requested regarding annual salary before deductions for income tax., social security, retirement, but excluding bonuses, overtime, and summer teaching. Salaries reported are median annual salaries, rounded to the nearest $100 and computed for full-time employed scientists and engineers. For individuals employed by educational institutions, no accommodation was made to convert academic-year salaries to calendar-year salaries. Users are advised that due to a wording change in the salary question, 1995 salary data are not strictly comparable with 1993 salary data.

Selected Employment Characteristics

This report contains several derived statistical measures reflecting labor force and employment rates as of April 1995:

Labor force participation rate. The labor force is defined as those employed (E) plus those unemployed (U—i.e., those not-employed persons actively seeking work). The labor force participation rate (R_{LF}) is the ratio of the labor force to the population (P).

$$R_{LF} = (E+U) / P$$

Unemployment rate. The unemployment rate (R^U) is the ratio of those who are unemployed but seeking employment (U) to the total labor force (E+U).

$$R_U = U / (E+U)$$

S&E involuntarily out-of-field rate. The S&E involuntarily out-of-field rate is the percent of employed individuals who reported they were either:

(1) working part-time exclusively because suitable full-time work was not available; and/or

(2) working in an area not related to the first doctoral degree (in their principal job) at least partially because suitable work in the field was not available.

APPENDIXES

Table A-1. Stratification, sample, and survey responses of doctoral scientists and engineers: 1995

Item	Sampling frame	Survey sample	Complete response	Ineligible response(1)	Non-response	Response rate(2)	Weighted response rate(3)
						(In percent)	
Total	594,275	49,829	35,370	2,946	11,513	76.9	85.4
Field of doctorate							
Chemistry	66,595	4,328	3,100	238	990	77.1	86.1
Physics/astronomy	42,898	3,368	2,396	213	759	77.5	85.4
Earth/ocean/atmospheric sciences	17,759	1,487	1,123	94	270	81.8	89.7
Mathematical sciences	28,016	2,298	1,620	176	502	78.2	86.6
Computer sciences	8,833	805	595	48	162	79.9	90.1
Agricultural sciences	28,369	2,351	1,640	198	513	78.2	87.4
Medical sciences	17,963	2,570	1,880	99	591	77.0	86.9
NIH biological sciences	66,507	9,129	6,781	357	1,991	78.2	86.9
Other biological sciences	50,713	3,541	2,639	195	707	80.0	88.3
Psychology	85,514	5,861	4,026	166	1669	71.5	81.5
Economics	23,156	1,384	888	125	371	73.2	80.6
Anthropology/archeology/sociology	24,803	1,868	1,326	139	403	78.4	87.5
Other social sciences	35,916	2,140	1,421	179	540	74.8	84.0
Electrical/electronics engineering	22,896	2,132	1,421	150	561	73.7	82.0
Other engineering	74,337	6,567	4,514	569	1484	77.4	85.2
Demographic characteristics							
U.S. Born:							
Handicapped	13,982	1,528	1,168	70	290	81.0	90.9
White	433,194	32,493	23,737	1,043	7,713	76.3	85.9
Black	7,633	1,572	1,181	34	357	77.3	80.4
Asian	6,753	1,413	974	104	335	76.3	86.6
Hispanic	5,713	1,333	992	39	302	77.3	88.0
Native American	919	280	216	7	57	79.6	85.4
Foreign Born:							
U.S. Citizen	40,283	4,235	3,043	214	978	76.9	85.6
Foreign Citizen	85,797	6,975	4,059	1,435	1,481	78.8	81.9
Sex:							
Male	471,067	37,496	26,361	2,425	8,710	76.8	85.0
Female	123,208	12,333	9,009	521	2,803	77.3	86.8
Year of Doctorate:							
1964 or Earlier	70,443	5,791	4,051	390	1,350	76.7	83.2
1965 to 1974	139,570	10,969	7,706	594	2,669	75.7	83.8
1975 to 1984	165,100	13,745	9,716	703	3,326	75.8	84.6
1985 to 1994	219,162	19,324	13,897	1,259	4,168	78.4	87.8

(1)The 2,946 ineligible responses include the following: doctorates living outside the U.S. during the week of April 15, 1995 (2,646); deceased (257); those who were institutionalized during the week of April 15, 1995 (27); over the age of 75 in April 1995 (11).

(2) The unweighted response rate is calculated as the total responses divided by the total sample.

(3) The weighted response rate is the total responses multiplied by their sample weights divided by the total sample multiplied by their sample weights. Nonrespondents to the mail that were followed-up via CATI carry an adjusted sample weight.

SOURCE: National Science Foundation/SRS, 1995 Survey of Doctorate Recipients

Table A-2. Classification of occupation categories: 1995

Total	010-500
Computer and mathematical scientists	052-054, 088, 172-176, 276,286
Computer and information scientists	052-054, 088
Mathematical scientists	172-176
Postsecondary teachers- Computer and mathematical sciences	276,286
Life and related scientists	021-025,027,271,273,287,297
Agricultural and food scientists	021
Biological scientists	22,23,25,27
Forestry and conservation scientists	024
Postsecondary teachers- Life and related sciences	271,273,287,297
Physical and related scientists	191-196,198,275,277,289
Chemists, except biochemists	192-195
Physicists and astronomers	191,196
Other physical scientists	198
Postsecondary teachers- Physical and related sciences	275,277,289
Social and related scientists	231-233,235-237,278,290,291,293,298
Economists	232
Political scientists	235
Psychologists	236
Sociologists and anthropologists	231,237
S&T historians and other social scientists	233
Postsecondary teachers- Social and related sciences	278,290,291,293,298
Engineers	082-099
Aerospace and related engineers	082
Chemical engineers	085
Civil engineers and architectural engineers	086
Electrical and related engineers	087,089
Industrial engineers	091
Mechanical engineers	094
Other engineers	083,084,090,092,093,095-099
Postsecondary teachers- Engineering	280
Managers, administrators, etc	141,151,152,153
Health and related occupations	111-114
Teachers, except S&E postsecondary teachers	251-257,272,274,279,281-285,288,292,294-296,299
Social services and related occupations	040,070,240
Technologists, etc	026,051,081,100-104,175,197
Sales and marketing occupations	200-203
Other non-S&E occupations	010,031-033,110,120,130,171,221-223,234,401-405,500

SOURCE: National Science Foundation/SRS, 1995 Survey of Doctorate Recipients

Table A-3: Listing of a and b parameters for selected demographic groups in science and engineering fields: 1995

Field of doctorate	Para-meter	All	Female	White	Asian	Black	Native American	Hispanic	1993-94 Cohort	Foreign
Total	a	-0.000023	0.000021	-0.000040	-0.000008	-0.000489	-0.000259	0.000299	-0.000277	-0.000316
	b	18.5899	13.0050	20.4266	12.7529	12.4291	17.1888	12.2297	17.4728	19.4170
Sciences	a	-0.000044	0.000034	-0.000054	-0.000301	-0.000591	0.001656	0.000504	-0.000367	-0.000515
	b	21.6561	12.5028	22.4212	16.0783	12.6927	17.1112	11.5813	18.1395	21.1058
Computer and mathematical sciences	a	-0.000853	-0.000015	-0.002698	-0.002373	-0.004981	-0.150946	0.018700	-0.002501	-0.000185
	b	28.0454	5.4012	42.0849	16.1405	12.7974	9.6391	8.6377	17.1318	11.4903
Computer and information sciences	a	-0.000885	-0.001217	0.000614	-0.006329	-0.019370	0.014536	0.003246	-0.003694	0.018624
	b	9.9392	2.3555	3.9946	15.0334	15.0256	-0.0976	10.0460	14.3085	0.8335
Mathematical sciences	a	-0.000540	0.000046	0.001772	-0.004289	-0.005817	-0.098259	0.030161	-0.000516	-0.001747
	b	25.5222	5.4909	16.5930	18.5153	12.1190	6.3232	6.7742	13.4704	7.1415
Life and related sciences	a	-0.000171	-0.000366	-0.000200	0.000106	0.002809	0.042462	-0.005573	-0.000787	-0.001571
	b	21.4545	17.6003	20.7956	12.1302	4.9851	3.5054	15.4796	14.1837	18.0885
Agricultural and food sciences	a	0.000163	-0.006782	0.001017	-0.006930	-0.001434	0.042462	-0.012383	0.024752	-0.025676
	b	10.6019	20.2661	7.9515	16.2664	8.1511	3.5054	8.5916	3.9799	19.1821
Biological and health sciences	a	-0.000224	-0.000376	-0.000213	0.000466	0.003153	0.049573	-0.005760	-0.000905	-0.001462
	b	21.8288	16.7396	20.7474	11.4164	4.9506	3.4480	15.4556	13.6868	15.0375
Environmental sciences	a	-0.001686	0.074768	-0.006754	-0.001703	0.589446	0.012913	0.292197	0.058142	-0.020755
	b	16.1779	5.2488	20.0928	5.4797	-5.2662	-0.0800	-2.4694	10.9223	6.3131
Physical and related sciences	a	0.000114	0.001052	0.000150	-0.000646	-0.007952	-0.007954	0.008160	-0.001299	-0.000207
	b	10.8529	4.6941	11.9211	11.7896	14.6432	11.6577	7.6114	13.1661	8.7183
Chemistry, except biochemistry	a	0.000223	0.000755	0.000128	-0.000721	-0.012689	0.027039	0.009031	-0.005039	-0.002139
	b	15.3418	6.0265	18.4545	11.0773	15.5033	3.6410	8.5310	21.1786	13.0193
Geology and oceanography	a	-0.000973	0.002054	-0.000910	-0.005124	0.474362	0.162483	0.046690	0.007492	-0.004373
	b	17.0479	3.3279	14.7055	17.6009	-2.0383	1.8659	8.9725	5.0869	6.4656
Physics and astronomy	a	0.000261	-0.005085	0.000689	-0.001293	0.001091	0.202934	0.021614	-0.004297	-0.004409
	b	5.1938	9.1354	1.5439	8.5745	3.9319	-0.1961	2.8557	13.7771	17.7154
Other physical sciences (Incl. earth)	a	0.001490	0.060666	0.018634	0.042892	0.293921	-0.007954	0.142239	0.371915	0.214456
	b	8.1617	5.8244	2.3477	7.3602	0.7987	11.6577	1.7752	-0.7142	-4.6815

See explanatory information and SOURCE at end of table.

Table A-3: Listing of a and b parameters for selected demographic groups in science and engineering fields: 1995

Field of doctorate	Para-meter	All	Female	White	Asian	Black	Native American	Hispanic	1993-94 Cohort	Foreign
Social and related sciences	a	-0.000066	0.000006	-0.000087	0.003467	-0.000784	0.055318	0.002348	-0.002276	0.002341
	b	24.1827	19.6173	26.2486	12.9711	14.0330	2.5704	8.8686	31.1131	11.8954
Economics	a	-0.001860	-0.002993	-0.009160	0.017416	0.018669	-0.195509	0.049109	-0.013244	0.008330
	b	50.0002	11.6143	45.5894	8.7259	16.8857	12.8549	6.8511	24.1809	8.6854
Political and related sciences	a	-0.000925	0.004913	-0.000972	-0.007520	0.034105	0.155827	0.054803	-0.011663	0.004232
	b	25.0215	4.1086	21.3615	11.0090	-0.5418	-17.4856	-3.9270	11.2798	14.4068
Psychology	a	0.000101	-0.000059	0.000096	-0.014189	-0.003263	0.093760	-0.005823	-0.003076	0.004409
	b	18.3531	24.0757	19.6472	21.6614	15.1217	5.0968	17.5394	25.2727	15.2624
Sociology and anthropology	a	-0.000641	-0.000753	-0.000650	-0.000186	0.001082	0.066320	0.005582	-0.013473	-0.010160
	b	17.4264	8.0744	15.9666	5.6019	3.8273	-0.2871	4.6923	15.0009	10.6842
Other social sciences	a	-0.000633	-0.000549	-0.000424	-0.004979	0.015130	0.026521	0.000459	-0.000846	0.016087
	b	19.1413	11.9950	15.8947	26.7948	6.5850	1.0566	7.0809	11.5407	14.5094
Engineering	a	-0.000135	-0.006390	0.000044	-0.000428	0.006469	-0.038454	-0.001188	0.004499	-0.001033
	b	14.6994	23.6020	8.1550	17.1424	5.2421	17.3361	13.3388	13.4102	19.4301
Aerospace/aeronautical	a	-0.007795	-0.097285	-0.012822	-0.066937	0.151322	-0.038454	-0.034138	-0.029052	0.004493
	b	15.7897	4.6514	13.8309	22.8680	-1.1424	17.3361	2.4502	12.7274	-0.1321
Chemical	a	0.001101	-0.001088	-0.000637	0.000236	0.112882	-0.038454	-0.028280	-0.002367	0.000898
	b	5.4395	3.9492	11.0768	6.2993	4.0044	17.3361	14.6285	9.1778	1.8737
Civil	a	-0.017836	-0.001847	-0.001201	0.002871	-0.009567	0.517931	0.048866	-0.012088	-0.009090
	b	39.3848	6.2769	9.2613	3.2557	11.2200	-2.1553	6.4519	16.6786	16.7293
Electrical/computer	a	-0.000520	-0.004639	0.002209	0.006563	0.039620	0.218413	-0.010227	-0.002568	-0.002608
	b	16.4161	7.4492	2.9594	6.4722	-0.1783	4.5607	10.2778	10.1329	12.9309
Industrial	a	-0.003107	0.041131	0.024767	0.004322	-0.047322	-0.038454	-0.149059	0.132530	-0.050017
	b	15.0343	4.8166	-1.6111	4.2404	10.7387	17.3361	16.1463	-3.5348	11.4787
Mechanical	a	0.000322	-0.026791	-0.007779	-0.004174	-0.045343	-0.038454	-0.074873	-0.000142	0.001539
	b	7.0706	10.4604	20.7584	12.6009	10.4651	17.3361	15.7967	3.3455	3.3271
Other engineering	a	0.000353	-0.015372	0.000582	-0.000662	0.021109	-0.050146	0.076911	-0.001470	0.006189
	b	10.6413	18.9641	6.4912	13.8365	9.0236	2.6865	-0.4487	24.4974	9.7376

SOURCE: National Science Foundation/SRS, 1995 Survey of Doctorate Recipients

Table A-4. Approximate standard errors of estimated number of doctoral scientists and engineers by field of doctorate: 1995

Estimated number	Total	Sciences					Engineering				
		Total	Computer and mathematical sciences	Life and related sciences	Physical and related sciences	Social and related sciences	Total	Chemical	Civil	Electrical/ Computer	Mechanical
50	30	30	40	30	20	30	30	20	40	30	20
100	40	50	50	50	30	50	40	20	60	40	30
200	60	70	70	70	50	70	50	30	80	60	40
500	100	100	120	100	70	110	90	50	120	90	60
700	110	120	140	120	90	130	100	70	140	110	70
1,000	140	150	160	150	100	160	120	80	150	130	90
2,500	220	230	250	230	170	250	190	140	--	190	140
5,000	300	330	340	320	240	350	260	230	--	260	210
10,000	430	460	440	440	350	490	370	410	--	330	320
25,000	670	720	410	660	590	750	530	--	--	--	--
50,000	930	990	--	800	910	1,020	630	--	--	--	--
75,000	1,120	1,170	--	800	1,210	1,200	590	--	--	--	--
100,000	1,270	1,310	--	660	1,490	1,330	--	--	--	--	--
150,000	1,500	1,510	--	--	--	1,470	--	--	--	--	--
200,000	1,670	1,610	--	--	--	--	--	--	--	--	--
250,000	1,780	1,640	--	--	--	--	--	--	--	--	--
300,000	1,860	1,600	--	--	--	--	--	--	--	--	--
400,000	1,920	1,300	--	--	--	--	--	--	--	--	--
500,000	1,850	--	--	--	--	--	--	--	--	--	--

KEY: '--' = Not applicable

SOURCE: National Science Foundation/SRS, 1995 Survey of Doctorate Recipients

Table A-5. Approximate standard errors of estimated number of women doctoral scientists and engineers by field of doctorate: 1995

Estimated number	Total	Sciences					Engineering				
		Total	Computer and mathematical sciences	Life and related sciences	Physical and related sciences	Social and related sciences	Total	Chemical	Civil	Electrical/ Computer	Mechanical
50	30	30	20	30	20	30	30	10	20	20	20
100	40	40	20	40	20	40	50	20	20	30	30
200	50	50	30	60	30	60	70	--	--	40	--
500	80	80	50	90	50	100	100	--	--	--	--
700	100	90	60	110	60	120	120	--	--	--	--
1,000	110	110	70	130	80	140	130	--	--	--	--
2,500	180	180	--	200	140	220	140	--	--	--	--
5,000	260	250	--	280	220	310	--	--	--	--	--
10,000	360	360	--	370	390	440	--	--	--	--	--
25,000	580	580	--	460	--	--	--	--	--	--	--
50,000	840	840	--	--	--	--	--	--	--	--	--
75,000	1,050	1,060	--	--	--	--	--	--	--	--	--
100,000	1,230	1,260	--	--	--	--	--	--	--	--	--

KEY: '--' = Not applicable

SOURCE: National Science Foundation/SRS, 1995 Survey of Doctorate Recipients

Table A-6. Approximate standard errors of estimated number of black doctoral scientists and engineers by field of doctorate: 1995

Estimated number	Total	Sciences					Engineering				
		Total	Computer and mathematical sciences	Life and related sciences	Physical and related sciences	Social and related sciences	Total	Chemical	Civil	Electrical/ Computer	Mechanical
50	20	30	30	20	30	30	20	20	20	10	20
100	40	40	40	20	40	40	20	--	30	20	20
200	50	50	50	30	50	50	40	--	--	40	--
500	80	80	--	60	70	80	70	--	--	--	--
700	90	90	--	70	80	100	80	--	--	--	--
1,000	110	110	--	90	80	120	--	--	--	--	--
2,500	170	170	--	--	--	170	--	--	--	--	--
5,000	220	220	--	--	--	--	--	--	--	--	--
10,000	270	--	--	--	--	--	--	--	--	--	--

KEY: '--' = Not applicable

SOURCE: National Science Foundation/SRS, 1995 Survey of Doctorate Recipients

Table A-7. Approximate standard errors of estimated number of Asian doctoral scientists and engineers by field of doctorate: 1995

Estimated number	Total	Sciences					Engineering				
		Total	Computer and mathematical sciences	Life and related sciences	Physical and related sciences	Social and related sciences	Total	Chemical	Civil	Electrical/ Computer	Mechanical
50	30	30	30	20	20	30	30	20	10	20	20
100	40	40	40	30	30	40	40	30	20	30	30
200	50	60	60	50	50	50	60	40	30	40	50
500	80	90	90	80	80	90	90	60	50	70	70
700	90	110	100	90	90	100	110	70	60	90	80
1,000	110	130	120	110	110	130	130	80	80	110	90
2,500	180	200	160	180	160	230	200	130	--	240	--
5,000	250	270	--	250	210	--	270	--	--	--	--
10,000	360	360	--	360	230	--	360	--	--	--	--
25,000	560	460	--	--	--	--	--	--	--	--	--
50,000	790	--	--	--	--	--	--	--	--	--	--

KEY: '--' = Not applicable

SOURCE: National Science Foundation/SRS, 1995 Survey of Doctorate Recipients

Table A-8. Approximate standard errors of estimated number of Hispanic doctoral scientists and engineers by field of doctorate: 1995

Estimated number	Total	Sciences					Engineering				
		Total	Computer and mathematical sciences	Life and related sciences	Physical and related sciences	Social and related sciences	Total	Chemical	Civil	Electrical/ Computer	Mechanical
50	20	20	20	30	20	20	30	30	20	20	20
100	40	30	30	40	30	30	40	30	30	30	30
200	50	50	50	50	40	40	50	40	--	40	--
500	80	80	90	80	80	70	80	--	--	--	--
700	90	90	120	90	100	90	90	--	--	--	--
1,000	110	110	--	100	130	110	110	--	--	--	--
2,500	180	180	--	60	--	190	--	--	--	--	--
5,000	260	270	--	--	--	--	--	--	--	--	--
10,000	390	--	--	--	--	--	--	--	--	--	--

KEY: '--' = Not applicable

SOURCE: National Science Foundation/SRS, 1995 Survey of Doctorate Recipients

Table A-9. Approximate standard errors for estimated percents of doctoral scientists and engineers: 1995

Base number of percent	Estimated percent						
	1 or 99	2 or 98	5 or 95	10 or 90	15 or 85	25 or 75	50
50	6.1	8.5	13.3	18.3	21.8	26.4	30.5
100	4.3	6.0	9.4	12.9	15.4	18.7	21.6
200	3.0	4.3	6.6	9.1	10.9	13.2	15.2
500	1.9	2.7	4.2	5.8	6.9	8.3	9.6
700	1.6	2.3	3.6	4.9	5.8	7.1	8.1
1,000	1.4	1.9	3.0	4.1	4.9	5.9	6.8
2,500	0.9	1.2	1.9	2.6	3.1	3.7	4.3
5,000	0.6	0.9	1.3	1.8	2.2	2.6	3.0
10,000	0.4	0.6	0.9	1.3	1.5	1.9	2.2
25,000	0.3	0.4	0.6	0.8	1.0	1.2	1.4
50,000	0.2	0.3	0.4	0.6	0.7	0.8	1.0
75,000	0.2	0.2	0.3	0.5	0.6	0.7	0.8
100,000	0.1	0.2	0.3	0.4	0.5	0.6	0.7
150,000	0.1	0.2	0.2	0.3	0.4	0.5	0.6
200,000	0.1	0.1	0.2	0.3	0.3	0.4	0.5
250,000	0.1	0.1	0.2	0.3	0.3	0.4	0.4
300,000	0.1	0.1	0.2	0.2	0.3	0.3	0.4
400,000	0.1	0.1	0.1	0.2	0.2	0.3	0.3
500,000	0.1	0.1	0.1	0.2	0.2	0.3	0.3

SOURCE: National Science Foundation/SRS, 1995 Survey of Doctorate Recipients

Table A-10. Approximate standard errors for estimated percents of women scientists and engineers: 1995

Base number of percent	Estimated percent						
	1 or 99	2 or 98	5 or 95	10 or 90	15 or 85	25 or 75	50
50	5.1	7.1	11.1	15.3	18.2	22.1	25.5
100	3.6	5.0	7.9	10.8	12.9	15.6	18.0
200	2.5	3.6	5.6	7.7	9.1	11.0	12.8
500	1.6	2.3	3.5	4.8	5.8	7.0	8.1
700	1.4	1.9	3.0	4.1	4.9	5.9	6.8
1,000	1.1	1.6	2.5	3.4	4.1	4.9	5.7
2,500	0.7	1.0	1.6	2.2	2.6	3.1	3.6
5,000	0.5	0.7	1.1	1.5	1.8	2.2	2.6
10,000	0.4	0.5	0.8	1.1	1.3	1.6	1.8
25,000	0.2	0.3	0.5	0.7	0.8	1.0	1.1
50,000	0.2	0.2	0.4	0.5	0.6	0.7	0.8
75,000	0.1	0.2	0.3	0.4	0.5	0.6	0.7
100,000	0.1	0.2	0.2	0.3	0.4	0.5	0.6

SOURCE: National Science Foundation/SRS, 1995 Survey of Doctorate Recipients

Table A-11. Approximate standard errors for estimated percents of black scientists and engineers: 1995

Base number of percent	Estimated percent						
	1 or 99	2 or 98	5 or 95	10 or 90	15 or 85	25 or 75	50
50	5.0	7.0	10.9	15.0	17.8	21.6	24.9
100	3.5	4.9	7.7	10.6	12.6	15.3	17.6
200	2.5	3.5	5.4	7.5	8.9	10.8	12.5
500	1.6	2.2	3.4	4.7	5.6	6.8	7.9
700	1.3	1.9	2.9	4.0	4.8	5.8	6.7
1,000	1.1	1.6	2.4	3.3	4.0	4.8	5.6
2,500	0.7	1.0	1.5	2.1	2.5	3.1	3.5
5,000	0.5	0.7	1.1	1.5	1.8	2.2	2.5
10,000	0.4	0.5	0.8	1.1	1.3	1.5	1.8

SOURCE: National Science Foundation/SRS, 1995 Survey of Doctorate Recipients

Table A-12. Approximate standard errors for estimated percents of Asian scientists and engineers: 1995

Base number of percent	Estimated percent						
	1 or 99	2 or 98	5 or 95	10 or 90	15 or 85	25 or 75	50
50	5.0	7.1	11.0	15.2	18.0	21.9	25.3
100	3.6	5.0	7.8	10.7	12.8	15.5	17.9
200	2.5	3.5	5.5	7.6	9.0	10.9	12.6
500	1.6	2.2	3.5	4.8	5.7	6.9	8.0
700	1.3	1.9	2.9	4.0	4.8	5.8	6.7
1,000	1.1	1.6	2.5	3.4	4.0	4.9	5.6
2,500	0.7	1.0	1.6	2.1	2.6	3.1	3.6
5,000	0.5	0.7	1.1	1.5	1.8	2.2	2.5
10,000	0.4	0.5	0.8	1.1	1.3	1.5	1.8
25,000	0.2	0.3	0.5	0.7	0.8	1.0	1.1
50,000	0.2	0.2	0.3	0.5	0.6	0.7	0.8

SOURCE: National Science Foundation/SRS, 1995 Survey of Doctorate Recipients

Table A-13. Approximate standard errors for estimated percents of Hispanic scientists and engineers: 1995

Base number of percent	Estimated percent						
	1 or 99	2 or 98	5 or 95	10 or 90	15 or 85	25 or 75	50
50	4.9	6.9	10.8	14.8	17.7	21.4	24.7
100	3.5	4.9	7.6	10.5	12.5	15.1	17.5
200	2.5	3.5	5.4	7.4	8.8	10.7	12.4
500	1.6	2.2	3.4	4.7	5.6	6.8	7.8
700	1.3	1.9	2.9	4.0	4.7	5.7	6.6
1,000	1.1	1.5	2.4	3.3	3.9	4.8	5.5
2,500	0.7	1.0	1.5	2.1	2.5	3.0	3.5
5,000	0.5	0.7	1.1	1.5	1.8	2.1	2.5
10,000	0.3	0.5	0.8	1.0	1.2	1.5	1.7

SOURCE: National Science Foundation/SRS, 1995 Survey of Doctorate Recipients